including the Welsh National School of Medicine, received £1,096,545 from public funds and £309,189 from other sources.

Of the total expenditure of £28,700,434, an increase of £2,568,312 or 9·8 per cent on 1951–52, administration accounted for 7·7 per cent, departmental maintenance 68·9 per cent, maintenance of premises 12·5 per cent, and miscellaneous expenditure 9·7 per cent. Capital expenditure met from income amounted to £334,516, and allocations to reserve to £334,015; for 1951–52 these figures were £258,963 and £222,536, respectively. Departmental maintenance, which includes salaries of teaching staff, payments for superannuation, the running costs of laboratories, lecture rooms, libraries and museums, and the supply of materials, apparatus, books, specimens, etc., increased by £1,665,428 to £19,761,880, and expenditure on the maintenance of buildings increased by 26·4 per cent. Salaries and superannuation amounted to £13,169,879 compared with £12,542,994 during 1951–52, the increase being 5 per cent for the teaching staff and 18·5 per cent for technicians and laboratory assistants.

Library expenditure, excluding general maintenance of library buildings, etc., rates, heat, light, repairs, etc., amounted to £1,118,428, or 3·9 per cent of the total expenditure, compared with 3·8 per cent during 1951–52 and 3·7 per cent during 1950–51. Of this total, £557,656 was for salaries and wages, £135,907 on periodicals and £90,072 on bindings. Of the £276,852 expended on books, £174,548 was in the schools and colleges of the University of London, including £9,800 at the Central Library, £7,222 at University College, £6,883 at the London School of Economics and £5,846 at the School of Oriental and African Studies. The University of Oxford spent £39,404 on books, Cambridge £16,014, Manchester £12,955, Liverpool £10,016, and Durham £10,265. The University of Bristol spent £9,739 on books, and the University of Southampton's expenditure of £9,152 is noteworthy in view of its smaller number of students; but although expenditure on books and periodicals continued to increase slightly, the upward trend was scarcely in proportion to the mounting costs of both books and periodicals. Only the Universities of London (£38,582), Cambridge (£10,247) and Oxford (£11,417) spent more than £10,000 on periodicals, and only Birmingham (£5,770), Leeds (£5,055) and Manchester (£5,460) more than £5,000. The University of Wales spent £11,869 on books and £7,987 on periodicals; in Scotland, Edinburgh spent £13,625 on books and £6,071 on periodicals; Glasgow, £13,421 and £7,711; Aberdeen, £6,619 and £3,733; and St. Andrews, £8,113 and £4,350.

SCIENCE IN THE EXTRA-MURAL WORK OF UNIVERSITIES

A SURVEY of some aspect of adult education from the pen of the *doyen* of heads of university extra-mural departments* is bound to attract attention and interest, and it is to be hoped that this essay will be carefully studied in responsible quarters. It will repay careful study, for there is much wisdom and good sense in its pages; but at the same time there is little to inspire, and the tone is cautious, almost apologetic. Thus, on p. 9 are set out the figures for courses in the sciences in relation to the total number of courses arranged by the universities and the Workers' Educational Association during the session 1952–53. Science provides 10 per cent of the total, and, while acknowledging that this represents "a considerable advance" on the 4 per cent of an earlier survey in 1925–26, Prof. Peers describes it as "remarkably low". In fact, however, an examination of the figures for all subjects scarcely confirms this judgment. In a total number of courses of 3,755 the physical and biological sciences, with 378, are exceeded by language and literature (623), the arts (599), history (597) and social studies (459). But the sciences in turn exceed international affairs (289), psychology (231), philosophy (186), religion (180) and government (128): biology alone provides more courses than philosophy, religion or government, and the physical sciences, with 167 courses, fall little short of religion. Given the inherent difficulties, which Prof. Peers does not fail to bring out, the position is less unsatisfactory than he suggests. Something must be allowed for variations in length of courses; but it remains remarkable that, in times like the present, international affairs should be less well represented. The student quoted by Prof. Peers who preferred "not to know the details" of the atom bomb that might blow her to pieces would seem to be as critical of international affairs as a subject of study. Here, perhaps, Prof. Peers's judgment is understandably coloured by the fact that his Department has a greater number of courses in international affairs than any other in the kingdom.

Nevertheless, Prof. Peers's approach is a sound one: "The real case for science as part of the general education of the adult citizen is exactly the same as the case for history, literature and the social sciences . . . without a knowledge of science he cannot live the best and most satisfying life of which he is capable: a whole range of experience, æsthetic as well as practical, is closed to him". This is well said, and the point is developed in some valuable paragraphs (pp. 6–7). It is doubtful, however, whether this view is sufficiently widely held in adult education circles. Prof. Peers quotes a science tutor's opinion as to the disadvantages caused by the unfamiliarity of organizers and administrators with science, only to brush it aside. He does not, however, seem to make sufficient allowance for the existence of latent demand. His argument that "it is not the business of Extra-mural Departments to use methods of persuasion to induce adult groups to choose one subject rather than another" begs the question, and reflects the conditions of an earlier period when 'demand' could be more easily recognized and satisfied. The task of the present in adult education, despite the great increase in the number of courses, is not to meet a recognizable and clamant demand, but to investigate society in order to ascertain where and how the universities, and other providers, can both stimulate and satisfy needs and interests. Prof. Peers offers some observations, based on the experience of several universities, on this aspect of the problem; but the investigation needs to be carried further and to be illustrated with actual syllabuses. His conclusion that little can be done "until science is given its proper place in the general curriculum of the schools" is open to question. Despite the arguments he offers, it is doubtful whether recollection of studies at school often encourages adult students

* Science in the Extra-Mural Work of Universities. By Prof. Robert Peers. Pp. 19. (Bristol: Universities Council for Adult Education, 1954.)

to attend courses in any subject. Nor is his criticism of "the absence of suitable text books" particularly valid, while his concern with "expensive microscopes and micro-projectors" as "a *sine qua non* of effective work" suggests a limited and specialist approach. It may be questioned, too, whether the claim that "the same objective methods" are used in the social sciences as in the physical can altogether be justified, while the criticism that the scientist is not necessarily dispassionate in his political or sociological judgments does not get us far: few of us would care to make even academic philosophers our kings.

Yet Prof. Peers offers some useful suggestions as to the development of courses in the sciences, and puts the subject in its proper perspective by proposing the establishment of science sub-departments of extra-mural departments, with the aim, above all, of achieving "the reintegration of science as an indispensable part of a liberal education". As a non-scientist he has rendered a valuable service in opening the subject for discussion: it is to the scientists in adult education that we now look for a more developed statement.

NUTRITION AND THE LIVER

SYMPOSIUM IN GLASGOW

ON May 8 the Scottish Group of the Nutrition Society held a symposium on "Nutrition and the Liver" in the Biochemistry Department of the University of Glasgow under the chairmanship of Prof. J. N. Davidson, head of the Department. This meeting provided an opportunity for workers in fields ranging from academic biochemistry to clinical medicine to pool their knowledge. Prof. Davidson introduced the subject with a short paper entitled "The Chemical Architecture of the Liver Cell", in which he described the technique of differential centrifugation, by means of which liver cells may be separated into a nuclear fraction, mitochondria, microsomes and the cell sap. He pointed out that mitochondria isolated in this way are morphologically different from mitochondria as seen in the living cell; furthermore, they are not a homogeneous population, since they can be subdivided into several chemically and enzymologically distinct fractions. The microsomal fraction is composed of minute particles, but these may represent the disintegration products of a reticulum in the cytoplasm of the living cell. Prof. Davidson then demonstrated that, although most chemical constituents of the liver are considerably affected by variations in nutritional status, the total amount of one component, deoxyribonucleic acid, remains unchanged even in the face of extreme dietary variations; the quantity of this component is determined solely by the number of cells present. Consequently, deoxyribonucleic acid can be used as a reference standard against which changes in other liver cell constituents can be measured. Examples were given of the misleading results which may be obtained when liver composition is expressed per 100 gm. of fresh tissue, and the clarification in interpretation which follows the expression of results in relation to deoxyribonucleic acid.

The influence of the protein and energy content of the diet on liver composition was considered by Dr. H. N. Munro (Department of Biochemistry, Glasgow). The amount of protein in the liver is considerably affected both by the level of protein and of energy intake. These changes in protein content occur much more rapidly and extensively in the liver than in most other tissues of the body. This has led to the supposition that the liver may contain a store of protein which is readily depleted under adverse nutritional conditions; but attempts to demonstrate a chemically discrete storage protein have not met with success. In parallel with changes in the protein content of the liver, there are also variations in ribonucleic acid and phospholipid content. These changes occur without any alteration in cell number, and the material so gained or lost has been named "labile liver cytoplasm" (Kosterlitz). By means of differential centrifugation of the liver into fractions, it has been shown that a reduction in protein intake causes a loss of protein from all parts of the liver cell, of ribonucleic acid principally from the microsomes, and of phospholipid from the microsomes and cell sap. Thus the material lost from various parts of the liver cell is not uniform in composition. Although the amount of ribonucleic acid is reduced by protein deficiency, its rate of synthesis seems to be independent of protein intake and to be determined by the level of energy intake. Dr. Munro concluded by suggesting that the failure to identify the labile protein of the liver with any single chemical or morphological entity within the liver cell could be readily explained if differences in the rates of protein synthesis in different tissues are considered. Such differences in rate will determine the speed with which these tissues adjust their protein content to altered dietary conditions. The liver, being among the most active in protein synthesis, will become rapidly adjusted, giving the impression of gaining or losing a labile protein component.

Dr. J. M. Naftalin (Rowett Research Institute) dealt with the production of liver necrosis in rats by dietary means. In summarizing the history of this subject, he pointed out that the two dietary conditions generally believed to be necessary for the production of liver necrosis are deficiency of sulphur-containing amino-acids and lack of vitamin E. His own investigations were aimed at determining the influence of restriction of food intake and of environmental temperature on the incidence of liver necrosis among animals receiving necrogenic diets. He observed that 70–78° F. (21·1–25·6° C.) is the optimal temperature for producing necrosis on diets deficient in vitamin E and low in sulphur-containing amino-acids, the incidence being considerably less at temperatures higher or lower than this. In addition, caloric restriction with the same diet reduces the frequency of necrosis. A sufficient degree of food restriction prevents liver necrosis at all environmental temperatures, but too severe restriction leads to death without necrosis. Variations in the incidence of necrosis also occur when different preparations of casein are used as the protein source in the necrogenic diet. The incidence of necrosis was found to depend on the origin of the casein and to be independent of alcohol–ether treatment used for the removal of vitamin contaminants. It is not yet known whether caseins differ in necrogenicity because of the presence of a toxic factor in the high-incidence preparations or of a protective factor in the low-incidence preparations.

Dr. E. Kodicek (Dunn Nutritional Laboratory, Cambridge) contributed a paper on the storage of vitamins in the liver which summarized much recent